

On the identity and taxonomic status of *Lycaenaalcon rebeli* HIRSCHKE, 1905 — a long story of confusion and ignorance resulting in the fabrication of a “ghost species” (Lepidoptera: Lycaenidae)

Otakar KUDRNA and Zdenek F. FRIC

Dr. Otakar KUDRNA, Geldersheimer Strasse 64, D-97424 Schweinfurt, Germany; kudrna.meb@t-online.de

Dr. Zdenek F. FRIC, Institute of Entomology, Biology Centre of the Academy of Sciences of the Czech Republic, Branišovská 31, CZ-37005 České Budějovice, Czechia; fric@entu.cas.cz

Abstract: The present paper describes the identity and taxonomic status and explains the taxonomic history of the butterfly originally named *Lycaenaalcon rebeli* HIRSCHKE, 1905 and generally misidentified and/or confused with *Maculinea rebeli xerophila* BERGER, 1946. It is shown that *Lycaenaalcon rebeli* HIRSCHKE, 1905, is a rare individual form confined to higher altitudes of the Alps. It is not closely related to *Maculinea rebeli xerophila* BERGER, 1946, or to any known lowland population of *Phengarisalcon* [SCHIFFERMÜLLER], 1775.

Keywords: Lepidoptera: Lycaenidae: *Phengarisalcon*. Taxonomy, nomenclature, variation, distribution.

Über Identität und taxonomischen Status von *Lycaenaalcon rebeli* HIRSCHKE, 1905 — eine lange Historie von Verwechslungen und Fehlidentifikationen, resultierend in einer „Geisterart“ (Lepidoptera: Lycaenidae)

Zusammenfassung: Die vorliegende Arbeit stellt anhand einer Untersuchung des Typenmaterials die Identität, den taxonomischen Status und die taxonomische Geschichte von *Lycaenaalcon rebeli* HIRSCHKE, 1905, eines fast seit seiner Urbeschreibung falsch identifizierten und zumeist mit *Maculinea rebeli xerophila* BERGER, 1946, verwechselten Taxons, dar. Es wird gezeigt, daß es sich bei *Lycaenaalcon rebeli* HIRSCHKE, 1905, um eine seltene alpine Individualform aus höheren Lagen handelt. Diese Form ist nicht näher verwandt mit *Maculinea rebeli xerophila* BERGER, 1946 oder mit einer anderen Tieflandform von *Phengarisalcon* [SCHIFFERMÜLLER], 1775).

Aims and scope

The purpose of the present paper is to explain the identity, taxonomic status and history of a butterfly discovered more than 100 years ago and named *Lycaenaalcon rebeli* HIRSCHKE, 1905. *Lycaenaalcon rebeli* has been misidentified in almost all subsequent publications from 1907 (SEITZ 1907–1909) to the present day. The case of this butterfly demonstrates both the importance of taxonomy as basic research and the damage caused by ignorance of facts, in this specific case leading to a fabrication of a ghost species combined with nomenclatorial confusion. Curiously, this “ghost species”, not the true *Lycaenaalcon rebeli* HIRSCHKE, 1905, has been intensively studied by a number of research teams all over Europe (e.g. research projects MacMan and CLIMIT, cf. SETTELE et al. 2005). The present paper constitutes a contribution towards stabilisation of the classification and nomenclature of European butterflies.

History, identity and taxonomic status of *Lycaenaalcon rebeli* HIRSCHKE, 1905

Over 100 years ago, Hans HIRSCHKE (1850–1921: [ANONYMUS] 1921), then a retired Austrian army captain (i.e. Hauptmann a.D.) spent the whole summer of 1904 in the Alps of Steiermark (Styria) collecting butterflies and moths in the Hochschwab mountains. There, at the altitude of approximately 1700 m, he found a striking and — to his opinion — in its features constant form of a ‘blue’ that he identified as “*Lycaenaalcon* F.” — according to the present classification *Phengarisalcon* ([SCHIFFERMÜLLER], 1775) (photos of the neotype see in Figs. 7–9). Later, back in Wien, he consulted H. REBEL at the Naturhistorisches Museum and compared his series of at least 8 specimens with 4 ♂♂ and 1 ♀ of *Phengarisalcon monticola* (STAUDINGER, 1901), apparently identified by H. REBEL. H. HIRSCHKE and H. REBEL considered that the Hochschwab series constitutes a then nameless “variety”. HIRSCHKE (1905) subsequently described and figured (see Figs. 10–11) the new form and named it after H. REBEL *Lycaenaalcon* var. *rebeli* (Figs. 1–6), now referable to the genus *Phengaris* DOHERTY, 1892.

This form was diagnosed to be easily distinguished by the presence of a band of whitish or silver-greyish spots in the blue ground colour in the submarginal band adjacent to the marginal black line on the upper side of wings, particularly well pronounced on the hind wings and especially in the ♀ (see lectotype and paralectotype, Figs. 1–6). We note that similar spots are quite common in *Phengaris teleius* (BERGSTRÄSSER, 1779). We are not aware of the genesis of such forms, but we know now that they are very rare in *Phengarisalcon* ([SCHIFFERMÜLLER], 1775). HIRSCHKE (1905) made no precise reference to the specific site within the type locality of the “Hochschwab”, a mountain crest in Nordsteiermark (northern Styria), about 30 km long, the peak of which is a mountain of the same name, Hochschwab, of an elevation of 2277 m. The type series was, according to the label data, found at about 1700 m on the southern slopes of this ridge. HIRSCHKE (1905) failed to state what he meant under the term “form” or “variety”, nothing unusual at his life time. According to the valid Code (ICZN 1999) the name is available and is to be regarded as of subspecific rank.

The first reference to *rebeli* as a form found in Steiermark in a standard handbook was made apparently by SEITZ (1909: 320). The wing pattern has not been cor-

rectly described and the taxon's characteristic "whitish spots" have been overlooked. We are convinced that this is almost certainly the first of a long series of misidentifications of *rebeli*.

After HIRSCHKE's death in 1921, at least a substantial part of his Lepidoptera collection came to the Natural History Museum in Vienna, where HIRSCHKE's conspicuous form remained more or less "forgotten" or "overlooked" for the following about 40 years. We do not know if all eight specimens of the original type series, all syntypes, have originally been deposited in the NHMW, probably not all. We know that a few specimens, almost certainly syntypes, are now in the Zoological Museum in Berlin (ZMHB) and in the Zoological Museum of the Kiev University (ZMKU).

After the Second World War, the Belgian lepidopterist L. A. BERGER (1907–2000) observed that *Phengaris alcon*, treated then in the genus *Maculinea* VAN ECKE, 1915, utilizes two different larval food plants and frequents two different types of habitat – wet meadows on one hand and dry meadows on the other. Having subsequently examined the ♂ genitalia of a few specimens, BERGER (1946) assumed that he had discovered adequate differences to attribute species rank to both phenotypes. Having observed a certain similarity of the Belgian phenotype inhabiting dry meadows and utilising *Gentiana cruciata* as a larval host plant with *rebeli*, BERGER (1946) named a new subspecies *Maculinea rebeli xerophila* BERGER, 1946 (Fig. 12), raising thus *rebeli* by implication to the rank of a species. Only a few ♀♀ of *xerophila* possess the whitish submarginal spots characteristic of HIRSCHKE's *rebeli*; the majority of BERGER's specimens lack these spots, particularly ♂♂, and are indistinguishable from nominotypical *alcon*. What BERGER (1946) observed was a simple variation of the valva; he took the apparently distinct genitalia for the confirmation of the species rank of what he deemed to be *rebeli*. However, the ♂ genitalia in *alcon* are by no means constant; on the contrary, the variable shape of the valva is quite usual in the genus (EBERT 1961, SCHULTE 1958).

The [holo-]type of *xerophila* as figured by BERGER (1946) does not appear to differ from *alcon*. However, the specimen deposited now in BERGER's collection and labelled "[holo-]type", a ♀, strongly reminds of *rebeli*, but it is not a part of the type series as it has not come from the type locality. The label data of this specimen are: "Belgique: Tellin C.: 21.06.1942". It appears that the true [holo-]type of *xerophila* is lost. *Phengaris alcon* is now extinct in Belgium; the site believed to be formerly inhabited by *alcon* (apparently including the type locality) of *xerophila* have been "improved" and grassland management intensified (S. CUVELIER, pers. com.).

BERGER's (1946) discovery of a supposedly new European butterfly species prompted Henri BEURET (1901–1960) to examine extensive material of both supposed species (BEURET 1949). BEURET's meticulous comprehensive study of a long series of specimens from a range of

localities failed to establish any constant taxonomic characters enabling the separation of what he then called "*Maculinea rebeli*" from "*Maculinea alcon*". This has not prevented BEURET (1949) from naming one new subspecies of *alcon* and five new subspecies of *rebeli*:

Maculinea alcon pseudoroboris BEURET, 1949 (CH: Tessin: Ascona: wetland form)

Maculinea rebeli alpicola BEURET, 1949 (CH: Wallis: Zermatt: 2000 m)

Maculinea rebeli magnalpicola BEURET, 1949 (CH: Tessin: Altanca, Fussio)

Maculinea rebeli macroconia BEURET, 1949 (CH: Appenzell: Narwie)

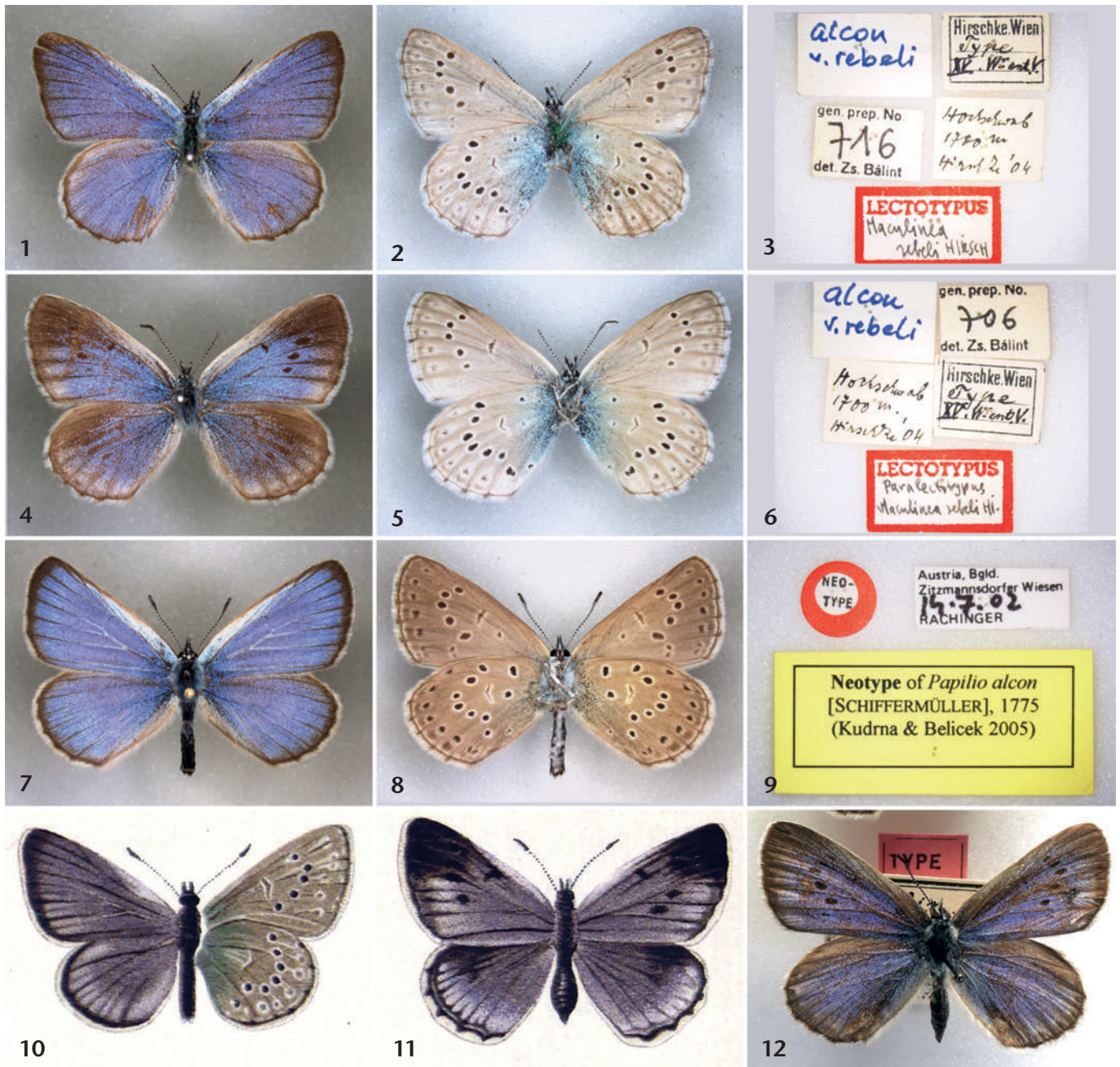
Maculinea rebeli gadmensis BEURET, 1949 (CH: Bern: Gadmen)

Maculinea rebeli cruciata BEURET, 1949 (CH: Jura: Südflanke des Blauen)

From BEURET's (1949) description it is clear that his "*rebeli*" was not the true *rebeli* of HIRSCHKE as none of the specimens he illustrated has the whitish submarginal spots (c.f. BEURET 1957 pl. 12). The specimens of the type-series of his new "subspecies" are inevitably individually variable specimens from different localities. Because the specimens were of different provenience, BEURET (1949) afforded the specimens from each locality a subspecies rank. The above names proposed by BEURET (1949) are available from a nomenclatorial point of view, but the taxa erected by him are not worthy of recognition as distinct subspecies.

Following BEURET (1949) and probably influenced by his extensive paper, FORSTER & WOHLFAHRT (1952–1955) treated what they called "*Maculinea rebeli* (HIRSCHKE, 1905)" as a distinct species and figured it from "[Austria]: Steiermark: Hochschwab" (pl. 24, figs. 28, 33, 35). WOHLFAHRT's precise illustrations agree well with the true *rebeli*; the illustrated specimens originated from the same locality as the type series, but do not constitute a part of it.

Commencing in 1970 (HIGGINS & RILEY 1970) and in the following decades a species called *Maculinea rebeli* or a subspecies called *Maculinea alcon rebeli* has been included practically in all European butterfly field guides. The name was accompanied by various descriptions and illustrations, all of which – so far as we have been able to examine – have failed to show or point out the whitish submarginal spots characteristic of the true HIRSCHKE's *rebeli*. However, these taxa were always attributed to HIRSCHKE and usually dated 1904 instead of the true date of publication 1905. It is interesting to observe that the authors of the field guides have overlooked or ignored WOHLFAHRT's precise illustrations (FORSTER & WOHLFAHRT 1952–1955). Thus we have to do with two taxa: HIRSCHKE's forgotten true *rebeli* on one hand and the misidentified "*rebeli*" of various authors on the other, erroneously attributed to HIRSCHKE by all authors concerned. Most recently TSHIKOLOVETS (2011: 199) as one of the few authors since FORSTER & WOHLFAHRT (1952–1955) figured a specimen of "*Glaucopsyche alcon rebeli* (HIRSCHKE, 1904



Figs. 1–6: Types of *Lycaenaalcon rebeli* HIRSCHKE, 1905. Figs. 1–3: Lectotype ♂ of *Lycaenaalcon rebeli* HIRSCHKE, 1905; Fig. 1 upper-, Fig. 2 underside, Fig. 3 labels. Figs. 4–6: Paralectotype ♀; Fig. 4 upper-, Fig. 5 underside, Fig. 6 labels. — Figs. 7–9: Neotype ♂ of *Papilioalcon* [SCHIFFERMÜLLER], 1775; Fig. 7 upper-, Fig. 8 underside, Fig. 9 labels. — Figs. 10–11: *Lycaenaalcon rebeli* HIRSCHKE, 1905, ♂, ♀; copied from original plate II of HIRSCHKE (1905). — Fig. 12: *Maculinea rebeli xerophila* BERGER, 1946, paratype ♀.

[sic])” from “AT: Hochschwab” now deposited in the Zoological Museum of the National Shevchenko University, Kiev, (ZMKU). This specimen may have originated from the type series and is now probably a paralectotype by implication; it is a ♂ showing weak whitish submarginal spots.

Z. BÁLINT has found the type series of *Lycaenaalcon rebeli* HIRSCHKE, 1905, in the Naturhistorisches Museum, Wien (NHMW), and designated the lectotype, a ♂, bearing the following label data: “*Lycaenaalcon rebeli*, Lectotypus: [Austria]: Steiermark: Hochschwab: 1700 m: vi. 1904: Type: HIRSCHKE [leg.]: det. Z. BÁLINT, 1990” (BÁLINT 1994: 73). The lectotype bears a label “type” of an unknown origin; since no type designation was published in the original paper (HIRSCHKE 1905) the whole

type series consisted of syntypes according to the Code (ICZN 1999), until the lectotype was designated. BÁLINT’s (1994) lectotype designation established the true identity of *rebeli*, but was overlooked by almost all subsequent authors. The exceptions are few and far between, e.g. KUDRNA (2001, 2002) and KUDRNA & BELICEK (2005). The last named authors have subsequently designated the neotype of *Papilioalcon* [SCHIFFERMÜLLER], 1775, deposited in the Naturhistorisches Museum, Wien (Vienna); the type locality is “Austria: Burgenland: Zitzmannsdorfer Wiesen: 14.07.2002, RACHINGER leg.” (KUDRNA & BELICEK 2005).

In his recent publication HABELER (2008) claims again a species rank for a butterfly he calls *Maculinea rebeli* (HIRSCHKE, 1904 [sic]); the author is aware of the origi-

nal description of *rebeli* and its various illustrations, but he fails to draw attention to the whitish submarginal spots on the dorsal surface of hind wings, the most characteristic feature of *rebeli*. The aforementioned whitish spots constitute the single character distinguishing *rebeli* from any other form (s.l.) of *Phengaris alcon* ([SCHIFFERMÜLLER], 1775). Thus, in fact, HABELER's (2008) considerations are not referable to *Lycaena alcon rebeli* HIRSCHKE, 1905, but to *Phengaris alcon* referred to as *P. rebeli* [auct. nec HIRSCHKE]. We hasten to add that HABELER (2008) has failed to find both the form *rebeli* and *alcon* in Hochschwab. Also our colleagues Z. BÁLINT and A. PAVLICKO have searched for and failed to find *Lycaena alcon rebeli* on two occasions in 2010 and 2011.

HABELER's (2008) view concerning the taxonomic status of what he calls *Maculinea rebeli* is based solely on indications. His *Phengaris rebeli* auct., nec HIRSCHKE, is the species known under its valid name as *Phengaris alcon* ([SCHIFFERMÜLLER], 1775). HABELER's (2008) considerations on the distribution and ecological preferences, however interesting they are, do not describe the "true" *rebeli*, a form which he has not found. His failure to find the true *rebeli* supports, in fact, our view on the status of *rebeli* as expressed further in this paper.

Material examined

In the course of this study, we have examined over 1200 specimens of *Phengaris alcon* deposited in the following museum collections: Naturhistorisches Museum, Wien (NHMW), Zoologische Staatssammlung, München (ZSM), Zoologisches Museum der Humboldt-Universität, Berlin (ZMHB), Koninklijk Belgisch Instituut voor Natuurwetenschappen, Bruxelles/Brussel (KBIN), Biologiezentrum des Oberösterreichischen Landesmuseums, Linz (BOLL), Tiroler Landesmuseum Ferdinandeum, Innsbruck (TLFI), Museum Haus der Natur Salzburg (MHNS) and Naturmuseum Südtirol, Bozen (NMSB).

Results

Phengaris alcon is a variable species. This makes selecting an exact figure of "true *rebeli*" impossible; there are transitional forms. The *rebeli* phenotype is more common in ♀♀ than in ♂♂. We estimate the number of "true" *rebeli* phenotypes examined in the course of this study at about 20 specimens. Approximately the same number of specimens may be regarded as "transitional", showing only traces of whitish spots characteristic of the *rebeli* phenotype. We have not come across recently collected specimens. At least some specimens of *rebeli* might be associated with limestone substrate, but for the lack of precise data, this observation is inconclusive.

With the exception of the type series of *Lycaena alcon rebeli* HIRSCHKE, 1905 itself and *Maculinea rebeli xerophila* BERGER, 1946, all specimens of the *rebeli* phenotype were found singly at altitudes ranging between 1600 and 1800 m in the Austrian Alps. We do not rule out the

possibility of the occurrence of *rebeli* in the Swiss Alps but we have not found any Swiss specimens of the *rebeli* phenotype in museum collections we have examined. The occurrence of the *rebeli* phenotype in Belgium is unexpected and deserves comments. There are 20 ♂♂ and 15 ♀♀ bearing type-labels in BERGER's collection. Of these only up to 10 ♀♀ have the characteristic whitish submarginal spots, there are no ♂♂ of the typical *rebeli* phenotype. The whole series of *xerophila* in BERGER's collection consists of 110 ♂♂ and 60 ♀♀. One could argue that such heavy overcollecting could have negatively influenced the survival of a small isolated colony. However, the presumed habitat is known to have been destroyed many years ago (S. CUVELIER pers. comm.).

Conclusion

Closing the taxonomic history of *Lycaena alcon rebeli* HIRSCHKE, 1905, we conclude that HIRSCHKE's "*Lycaena alcon rebeli*" is a rare individual form found occasionally at high altitudes, probably restricted to the altitudes ranging from 1600 to 1800 m, in the Austrian Alps; it may be in some way associated with limestone substrate. Most of the specimens we have examined have been found in the Hochschwab mountains, but there are no recent records from the locality (s.l.). We cannot offer any rational explanation of the unexpected appearance of a *rebeli*-like form in Belgium, which is now extinct.

Four taxa, nomenclaturally of subspecies rank, have occasionally been regarded as taxonomically closely related to *Lycaena alcon rebeli* HIRSCHKE, 1905:

Lycaena alcon haurii FRUHSTORFER, 1917 (syntypes in ZSM), Switzerland: Graubünden: Filisur: 1000–1100 m).

Lycaena alcon monticola STAUDINGER, 1901 (syntypes in ZMHUB), Mountains in Switzerland and Caucasus).

Lycaena alcon sebastos REBEL & ZERNY, 1931 (syntypes in NHMW), Albania: Shkala e Bicajt, Beshtriq.

Lycaena alcon tolistus FRUHSTORFER, 1917 (syntypes in: depository?): Bosnia: Koricna.

Although we have not examined the type material of the last named taxon, we regard all four as junior subjective synonyms of *P. alcon*, as they are not worthy of recognition at the rank of subspecies on taxonomic grounds.

Four Euro-Siberian species of the genus *Phengaris* DOHERTY, 1892, live in Europe and are more or less widespread in Central Europe: *Phengaris alcon* ([SCHIFFERMÜLLER], 1775, *P. arion* (LINNAEUS, 1758), *P. nausithous* (BERGSTRÄSSER, 1775) and *P. teleius* (BERGSTRÄSSER, 1775). Since the extinction and successful re-establishment in Great Britain of *Phengaris arion* they are considered threatened. Their ecology and conservation biology has been intensively studied almost all over Europe, particularly in the EU, for more than the last 20 years thanks to generous funding made available by the EU and some national authorities (e.g. MacMan, CLIMIT and related major international projects, cf. SETTELE et al. 2005). It is strange that one species has been studied

under two different names – *P.alcon* and *P.rebeli* –, the latter misidentified in two respects including authorship, although KUDRNA (2001, 2002) pointed out its true identity, questionable taxonomic status and authorship.

Discussion

We anticipate that a number of specific questions may be asked by readers, conservationists and ecologists. We offer the following answers in advance:

Are the whitish submarginal spots the only constant taxonomic character of *rebeli*?

Yes, they are. All features attributed to *rebeli* in all descriptions in any publication we have consulted constitute simple individual variation of *alcon*. This pattern of variation is quite characteristic of several “blue” genera of the family Lycaenidae. Incidentally, the lectotype shows whitish submarginal spots poorly pronounced. It might have been better to select a ♀ as the lectotype.

There is an additional feature characteristic of *rebeli* ♀♀: The apex of the forewings is extensively suffused with black scales; this applies to a slightly lesser degree also to the hindwings.

Is *Lycaenaalconrebeli* an ecological race?

Not according to our present knowledge. MAYR (1971) called clearly distinguishable phenotypes linked to and exclusive of a specific environment (e.g. habitat type or geological substrate) and constant within it “ecological races”. LORKOVIC (1974) attributed certain types of constant variation to the substrate dependent adaptability, as exemplified by *Hipparchia statilinus* (HUFNAGEL, 1766). KUDRNA (1977) described similar phenomena, too, and, named them “pseudopolytypism” to distinguish them from truly polytypical species. Whitish submarginal spots in *rebeli* are not present in all individuals of any known population, and no link to a specific environment is evident at present.

What is the distribution of the form *rebeli*?

The form *rebeli* has no definite range and therefore it can not be a subspecies by definition. Since *rebeli* is according to our present knowledge not a form exclusive and dominating of a certain substrate or habitat type, it cannot be regarded as an ecological race (cf. MAYR 1971). Nonetheless, it would be interesting to study the variation of *P.alcon* at high altitudes in the Alps with special reference to the sites with limestone substrate.

What is the larval host plant of the form *rebeli*?

We do not know. The field guides generally claim that it is *Gentiana cruciata* whereas *G. (Gentianella) germanica* is only occasionally mentioned. However, the butterfly called “*rebeli*” in the field guides is a misidentified xerophilous *alcon*; the vast majority of records of *rebeli* is based in the false assumption that *alcon* found in dry

habitats is *rebeli*, which is not true, as we have shown. HABELER (2008) and his friends failed to find *G. cruciata* in the Hochschwab mountains. We have consulted a botanical expert. J. GREIMLER (pers. comm.) informed us that *G. cruciata* does not grow in the Hochschwab at the altitudes of 1600–1800 m where the form *rebeli* has been found, but it is confined to low altitudes, usually below 1200 m, where it is rare. The following *Gentiana* resp. *Gentianella* species have been recorded in the Hochschwab mountains: *G. verna*, *G. stiriaca*, *G. asclepiadea*, *G. pannonica*, *G. clusii*, *G. pumila*, *G. bavarica*, *G. orbicularis*, *G. nivalis* and possibly *G. punctata*. Some of these species are referable to the subgenus *Gentianella*, which is currently being regarded as a distinct genus by some botanists.

Does supposed utilisation of a different larval food plant justify a taxonomic rank?

No! Utilisation of different host plants in different parts of the species range is not unusual and does not justify separating butterfly taxa at species or subspecies rank. The same applies to habitat preferences. The selection of different food plants and utilisation of different habitats are preconditions of the expansion of any species (cf. ecological valency).

What is the host ant of *rebeli*?

In the course of myrmecological research in the Hochschwab mountains, carried out by H. C. WAGNER (pers. comm.) in 2009, four *Myrmica* species have been recorded. Three species are abundant at the altitudes ranging from 1600–1800 m: *Myrmica sulcinodis*, *M. ruginodis* and *M. lobulicornis*. The fourth species is *M. scabrinodis*; it is rare – only one nest has been found at the altitude of about 1700 m. Furthermore, as a fifth species *M. lobicornis* might be expected, being probably the rarest species of this genus in this area.

What is the true date of publication of *Lycaenaalconrebeli* HIRSCHKE?

It is 1905! The original description was published in the volume scheduled for 1904, but it was published in the following year 1905. The true date of publication, not necessarily the date printed on the wrapper, is decisive for all nomenclatural and taxonomic purposes (ICZN 1999).

What is the taxonomic value of male genitalia in *Phengarisalcon*?

BERGER (1946) claimed to be able to distinguish *alcon* from *xerophila* according to the length of a hook and small teeth on the outer distal margin of the valva in *rebeli xerophila*. KORB (2011) claimed that *rebeli* is an alpine subspecies of *Phengarisalcon*, distributed in Central and South Europe, and that the diagnostic character is a short tooth on distal part of valva with broad basal part. We have genitalised *alcon* specimens from several

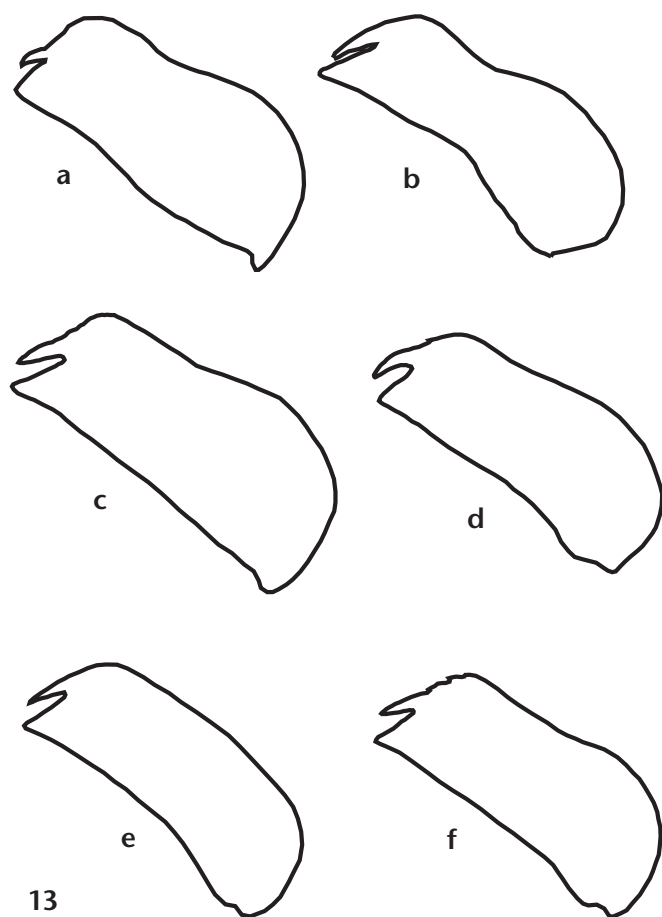


Fig. 13: Different forms of left valva from ventral view of a: lectotype of *rebeli*, b: paratype of *xerophila*, c: *alcon* from Kazakhstan, d: *alcon* from Czechia (wet habitat), e: Czechia (dry habitat), f: south Ural Mts.

parts of its range, from Switzerland to Kazakhstan. These characters, i.e. the length of the tooth and the shape of its base, are highly variable (Fig. 13). We are unable to confirm the presence of small teeth on the outer angle of the distal margin of one of BERGER's paratypes. However, we note that such teeth are present in several wetland specimens of *alcon*, for instance from the Ural Mountains and from S. Bohemia (Czechia).

What is the taxonomic value of the wing pattern in *Phengaris alcon*?

The wing pattern in *Phengaris alcon* is highly variable, although the species does not appear much variable from a molecular point of view. The dots and shades of blue are not constant taxonomic characters. It was repeatedly shown that wing pattern can be strongly affected by environmental conditions (cf. OTAKI et al. 2010). For instance, it is established that cooler conditions can produce darker phenotypes (KARL et al. 2009). The forms *haurii*, *tolistus* and *sevastos* are not worthy of recognition as distinct subspecies, not to mention the species rank. All the supposed differences between populations attributed to "*Phengaris rebeli*" auct., nec HIRSCHKE, on one hand and the rest of *Phengaris alcon* populations on the other are likely to be caused by various microhabitat adaptations: "*alcon*" to wet grassland and "*rebeli*" to dry

grassland (BERECZKI et al. 2005 and references therein).

The characteristic whitish spots can sometimes also be observed in other *Phengaris* species, e.g. in *P. teleius*.

Can *Phengaris alcon* be split into two distinct species on account of molecular or phylogenetic data?

The phylogenetic analysis shows that there is no sound argument for retaining xerophilous populations of *P. alcon* (incorrectly referred to as *P. rebeli*) as a separate species (ALS et al. 2004, PECH et al. 2004). Furthermore, the data available (ALS et al. 2004) suggest that the "hygrophilous phenotype" is ancestral and that the "xerophilous phenotype" originated independently several times. In no analysis of any data combinations do *alcon* and "*rebeli*" form monophyletic sister-groups. The polyphyly is more evident from the work of BERECZKI et al. (2005): Different lineages of "*rebeli*" are genetically closer to "*alcon*" than to other populations of "*rebeli*". However, it has to be stressed that no true Alpine *rebeli* sensu HIRSCHKE (1905) has been phylogenetically examined since no suitable recent specimens have been available. The same applies to "barcoding", not to mention thorough molecular examination. Samples of *Phengaris alcon* from different parts of its distribution range show very small molecular variation and no clear pattern related to geographical origin or habitat type. Even high alpine specimens from the Gruppo di Brenta, an isolated mountain group situated in Trentino (N. Italy) about 500 km SWW of the Hochschwab, fall within the remaining *alcon* samples (Fig. 14, voucher no. AB9 12).

What is the valid generic name: *Phengaris* DOHERTY, 1892, or *Maculinea* VAN EECKE, 1915?

It is opportune to repeat briefly a recent statement concerning the classification of the genus *Phengaris* (cf. FRIC et al. 2010). DOHERTY (1892) proposed the genus *Phengaris* for *Lycaena atroguttata* OBERTHÜR, 1876 (type species by monotypy). BETHUNE-BAKER (1914) established the genus *Iolana* and included the following four species: *Lycaena iolas* OCHSENHEIMER, 1816 (type species by original designation), *Lycaena gigantea* GRUM-GRSHIMAILO, 1885, *Lycaena coeligena* OBERTHÜR, 1876, and *Lycaena astraea* FREYER, 1852. Furthermore, DOHERTY (1892) discussed the classification of the remaining blues and assumed that *Papilio arion* LINNAEUS, 1758, is the type species of the genus *Lycaena* FABRICIUS, 1807; he also noted that these butterflies are taxonomically related to the *Glaucopsyche* SCUDDER, 1872 (type species *Polyommatus lygdamus* DOUBLEDAY, 1841).

VAN EECKE (1915) proposing the genus *Maculinea* (type species *Papilio alcon* [SCHIFFERMÜLLER], 1775) took only European species into account and included also *Papilio cyllarus* ROTTEMBURG, 1775 (= *Papilio alexis* PODA, 1761). Thus VAN EECKE (1915) in fact created a junior subjective synonym of both SCUDDER's *Glaucopsyche* and BETHUNE-BAKER's *Iolana*. The only difference was that VAN EECKE designated *Papilio alcon* as the type species.



Fig. 14: Phylogenetic relationships of *Phengaris alcon* constructed from four genes (COI, COII, wingless, Ef-1 α). The sample codes represent voucher codes used in GenBank (www.ncbi.nlm.nih.gov) except for samples AB3 13, AB9 12 and ZF LY 000459, added for comparison.

Only after WWII the use of the generic name *Maculinea* for the species group consisting of *Papilio alcon* [SCHIFFERMÜLLER], 1775, *Papilio arion* LINNAEUS, 1758, *Lycaena arionides* STAUDINGER, 1887, *Papilio nausithous* BERGSTRÄSSER, 1779, and *Papilio teleius* BERGSTRÄSSER, 1779 has become dominant, probably following VERITY (1943).

Conservationists, who object to the use of the name *Phengaris* and request its suppressing in favour of *Maculinea*, overlook that this is not a mere nomenclatural change of a name as such but a change of taxonomic status following new research results that make the change of the name necessary. The purpose of the Code and the ICZN is not suppressing the advancement of zoological research. Furthermore, most conservationists perceive *Maculinea* as a European genus; they overlook that *Phengaris* is a Euro-Asiatic genus and the species they know from Europe are also widespread throughout Siberia to the Far East.

The taxonomic history of this case can thus be summarized as follows: FIEDLER (1998: 3 [footnote]) and PIERCE et al. (2002) pointed out that species referable to *Maculinea* s. str. are closely related to *Phengaris*. PECH et al. (2004) published results of morphologically based phylogenetical analysis of *Maculinea* and *Phengaris*. A few weeks later ALS et al. (2004) published a molecular analysis of both former genera. Although the position of species of *Phengaris* s. str. and *Maculinea* s. str. differed between these two works, in both of them *Maculinea* was classified as paraphyletic relative to *Phengaris*. Finally FRIC et al. (2007) published a combined analysis of molecular and morphology characters and concluded that *Maculinea* is a junior subjective synonym of *Phengaris*.

Acknowledgements

We have studied material, including types, deposited in the following museums and institutes: Naturhistorisches Museum Wien (Vienna, NHMW), Zoologische Staatssammlung München (Munich, ZSM), Museum für Naturkunde Berlin (ZMHB), Koninklijk Belgisch Instituut voor Natuurwetenschappen, Brussels (KBIN), Biologiezentrum des Oberösterreichischen Landesmuseums Linz (BOLL), Tiroler Landesmuseum Ferdinandeum Innsbruck (TLFI), Museum Haus der Natur Salzburg (MHNS) and Naturmuseum Südtirol, Bozen (NMSB). We greatly appreciate kind help received from their scientific and curatorial staff, especially Dr. W. DEKONINCK (KBIN), Dr. S. GAAL-HASSLER (NHMW), Mag. F. GUSENLEITNER (BOLL), S. KERKHOF (KBIN), P. LIMBOURG (KBIN), Dr. P. GROS (MHNS), Dr. M. LÖDL (NHMW), Dr. W. MEY (ZMHB), C. VAN NIEUWENHOVE (KBIN), Dr. A. SEGERER (ZSM), R. ZARRE (BOLL). We thank Dr. M. LÖDL (NHMW) who has made for us photographs of the types of *Papilio alcon* [SCHIFFERMÜLLER], 1775 and *Lycaena alcon rebeli* HIRSCHKE, 1905 (the latter set on very thin old and bend “white” pins). We also thank S. LIMBURG (KBIN) for photos of the type material of *Maculinea rebeli xerophila* BERGER, 1946.

It is our particular pleasure to thank Dr. Z. BÁLINT who re-discovered the types of *Lycaena alcon rebeli* HIRSCHKE, 1905 in the collections of the Naturhistorisches Museum, Wien, and designated the lectotype; we value the exchange of opinions on the classification of the group and respect his views, although we do not share them.

We have a great pleasure to thank our colleagues Dr. K. ČERNÝ, S. CUVELIER, Univ.-Prof. Dr. J. GREIMLER, H. HABELER, Dr. A. PAVLICKO, H. C. WAGNER and Dr. M. WIE-

MERS; their help has been most useful for the successful completion of this paper.

The research leading to this publication constitutes a part of CLIMIT (www.climit-project.net, an internationally funded project of the Helmholtz Centre for Environmental Research – UFZ). The project funds covered a substantial part of the expenses involved with visits of the above mentioned museums in search of material including the examination of type material. A smaller proportion of the expenses had to be covered by one of the authors (O.K.) from his pension.

References

- ALS, T. D., VILA, R., KANDUL, N. P., NASH, D. R., YEN, S. H., HSU Y. F., MIGNAULT, A. A., BOOMSMA, J. J., & PIERCE, N. E. (2004): The evolution of alternative parasitic life histories in large blue butterflies. – *Nature*, London, **432**: 386–390.
- [ANONYMOUS] (1921): Hans HIRSCHKE. – *Zeitschrift des Österreichischen Entomologen-Vereins*, Wien, **6**: 39–40.
- BÁLINT, Z. (1994): Adalékok a Balkán boglárkalepke-faunájához. [Contribution to the lycaenid butterfly fauna of the Balkans]. – *A Janus Pannonius Múzeum Évkönyve*, Pécs, **39**: 69–77.
- BERECZKI, J., PECSENEY, K., PEREGOVITS, L., & VARGA, Z. (2005): Pattern of genetic differentiation in the *Maculinea alcon* species group in Central Europe. – *Journal of Zoological Systematics and Evolutionary Research*, Oxford & Berlin, **43**: 157–165.
- BERGER, L. (1946): *Maculinea rebeli* HIRSCHKE, bona species. – *Lam-billionea*, Brussels, **46**: 95–110.
- BETHUNE-BAKER, G. T. (1914): Synonymic notes on the Ruralidae. – *The Entomologist's Record and Journal of Variation*, London, **26**: 159–164.
- BEURET, H. (1949): Contribution à l'étude du groupe *Maculinea alcon* SCHIFF.–*rebeli* HIRSCHKE. – *Bulletin de la Société entomologique de Mulhouse*, Mulhouse, **1949**: 1–6, 9–14, 17–21, 25–28, 33–36, 41–44, 49–51.
- (1953–1961): Die Lycaeniden der Schweiz (3 parts). – Basel (Entomologische Gesellschaft), 420 pp., 3 pls.
- DOHERTY, W. (1892): New and rare Indian Lycaenidae. – *Journal of the Asiatic Society of Bengal*, Calcutta, **60** [1891]: 32–38.
- EBERT, G. (1961): Vorkommen und Verbreitung einiger schwieriger Rhopaloceren-Arten in Nordbayern. – *Nachrichtenblatt der Bayerischen Entomologen*, München, **10**: 49–56, 59–67.
- FIEDLER, K. (1998): Lycaenid-ant interactions of the *Maculinea* type: tracing their historical roots in a comparative framework. – *Journal of Insect Conservation*, London, **2** (1): 3–14.
- FORSTER, W., & WOHLFAHRT, T. A. (1952–1955): Die Schmetterlinge Mitteleuropas. Bd. 2. Tagfalter. – Stuttgart (Franckh'sche Verlagshandlung), [viii] + 126 pp., 28 col. pls. + legends.
- FRIC, Z., KUDRNA, O., PECH, P., WIEMERS, M., & ZRZAVY, J. (2010): Comment on the proposed precedence of *Maculinea* VAN ECKE, 1915 over *Phengaris* DOHERTY, 1891 (Lepidoptera, Lycaenidae). (Case 3508; see BZN **67**: 129–132). – *Bulletin of Zoological Nomenclature*, London, **67**: 315–319.
- , WAHLBERG, N., PECH, P., & ZRZAVY, J. (2007): Phylogeny and classification of the *Phengaris*-*Maculinea* clade: Total evidence and phylogenetic species concepts. – *Systematic Entomology*, London, **32**: 558–567.
- HABELER, H. (2008): Die subalpin-alpinen Lebensräume des Bläulings *Maculinea rebeli* (HIRSCHKE, 1904 [sic]) in den Ostalpen. – *Joannea, Zoologie*, Graz, **10**: 143–164.
- HIGGINS, L. G., & RILEY, N. D. (1970): A field guide to the butterflies of Britain and Europe. – London (Collins), 380 pp.
- HIRSCHKE, H. (1905): Eine neue hochalpine Form der *Lycaena alcon* F. aus den steirischen Alpen. – *Jahresbericht des Wiener Entomologischen Vereins*, Wien, **15** [1904]: 109–111, pl. II.
- ICZN [INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE, ed.] (1999): International Code of Zoological Nomenclature, fourth edition, adopted by the International Union of Biological Sciences. – London (International Trust for Zoological Nomenclature, BMNH), xxix + 306 pp. – The Code can also be found in the WWW under iczn.org.
- KARL, I., GEISTER, T. L., & FISCHER, K. (2009): Intraspecific variation in wing and pupal melanization in copper butterflies. – *Biological Journal of the Linnean Society*, London, **98**: 301–312.
- KORB, S. K. (2011): A review of the subgenus *Maculinea* VAN ECKE, 1915 of the genus *Phengaris* DOHERTY, 1891 of the Palaearctic fauna. – *Eversmannia*, Tula, **27/28**: 22–46.
- KUDRNA, O. (1977): A revision of the genus *Hipparchia* FABRICIUS. – Faringdon (E. W. Classey), 300 pp.
- (2001). Miscellaneous notes on the taxonomy of four European butterflies. – *Entomologist's Gazette*, Faringdon, **52**: 253–261.
- (2002): The distribution atlas of European butterflies. – *Oedippus*, Schweinfurt, **20**: 1–342.
- & BELICEK, J. (2005). On the “Wiener Verzeichnis”, its authorship and the butterflies named therein. – *Oedippus*, Schweinfurt, **23**: 1–32.
- LORKOVIC, Z. (1974): Die Verteilung der Variabilität von *Hipparchia statilius* HUFN. in Beziehung zum Karstboden des ost-adriatischen Küstenlandes. – *Acta Entomologica Jugoslavica*, Zagreb, **10**: 41–53.
- MAYR, E. (1971): Populations, species and evolution. – Cambridge, Mass. (Harvard University Press), 468 pp.
- OTAKI, J. M., HIYAMA, A., IWATA, M., & KUDO, T. (2010): Phenotypic plasticity in the range-margin population of the lycaenid butterfly *Zizeeria maha*. – *BMC Evolutionary Biology*, London, Berlin, Heidelberg, **10**: 252 (www.biomedcentral.com/1471-2148/10/252).
- PECH, P., FRIC, Z., & KONVICKA, M., & ZRZAVY, J. (2007): Species-specificity of the *Phengaris* (*Maculinea*)-*Myrmica* host system: Fact or myth? – *Sociobiology*, Chico (Calif.), **50** (3): 1–21.
- , —, & — (2004): Phylogeny of *Maculinea* blues based on morphological and ecological characters: evolution of parasitic myrmecophily. – *Cladistics*, London, **20**: 362–375.
- PIERCE, N. E., BRABY, M. F., HEATH, A., LOHMAN, D. J., MATHEW, J., RAND, D. B., & TRAVASSOS, M. A. (2002): The ecology and evolution of ant association in the Lycaenidae (Lepidoptera). – *Annual Review of Entomology*, Stanford (USA), **47**: 733–771.
- SCHULTE, A. (1958): Verschiedene Valvenformen als Hauptunterscheidungsmerkmal der Lycaeniden: *Maculinea alcon* SCHIFF. und *Maculinea rebeli* ssp. *xerophila* BERGER im nordwestdeutschen Raum. – *Entomologische Zeitschrift*, Stuttgart, **68** (20): 233–234.
- SCUDDER, S. G. (1872): A systematic revision of some of the American butterflies; with brief notes on those known to occur in Essex County, Mass. – Fourth Annual Report of the Trustees of the Peabody Academy of Science for the year 1871: 24–83.
- SEITZ, A. (1909): 34. Gattung: *Lycaena* F. – Pp. 298–322, pls. 78–83. – In: SEITZ, A. (1907–1909), Die Groß-Schmetterlinge der Erde. Eine systematische Bearbeitung der bis jetzt bekannten Großschmetterlinge. I. Abt., Die Großschmetterlinge des Palaearktischen Faunengebiets. 1. Bd., Die palaearktischen Tagfalter. – Stuttgart (F. Lehmann), [4] + [A–C] + 379 pp. + 89 pls.
- SETTELE, J., KÜHN, E., & THOMAS, J. (eds.) (2005): Studies on the ecology and conservation of butterflies in Europe. Vol. 2. Species ecology along a European gradient: *Maculinea* butterflies as a model. – Sofia & Moscow (Pensoft), 289 pp.
- TSHIKOLOVETS, V. V. (2011): Butterflies of Europe & the Mediterranean area. – Pardubice (Tshikolovets Publications), 544 pp.
- VAN ECKE, R. (1915). Bijdrag tot de kennis de Nederlandske *Lycaena*-sorten. – *Zoologische Mededelingen*, Leiden, **1**: 22–31.
- VERITY, R. (1943): Le farfalle diurne d'Italia. Vol. 2. Divisione Lycaenida. – Firenze (Casa Editrice Marzocco), 401 pp.

Received: 19. III. 2013